Fruit, vegetable and cereal intake of Polynesian and European women in Auckland

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Abstract

Differences in the intake of specific food plants by Polynesian and European people of New Zealand may contribute to the lower incidence of colorectal cancer in Polynesians. Some food plants are known to contain protective chemical components against diseases. But in New Zealand, Polynesians (including Maori and Pacific people) have more colorectal cancer risk factors than Europeans. These risk factors include high rates of obesity, intake of alcohol, dietary fat and total energy.

We compared the consumption of food plants recorded in seven-day food diaries kept by 80 (18-27 years) Polynesian and European women. Half of each ethnic group had a body mass index (BMI) greater than 30 $kg.m^{-2}$. The volunteers with a BMI of 30 $kg.m^{-2}$ were defined as obese. The food diaries were examined for the number of servings of fruits, vegetables and cereals eaten by the women. The effects of obesity and ethnicity were examined. Only one food, deep fried potato chips was eaten in significantly greater quantities by the Polynesian women in the study. Eight plants were eaten exclusively by Polynesian women and two were eaten exclusively by European. Obese women ate more broccoli and less carrot, apricots, kumara and boiled rice than the non-obese. The recommendation of five servings of fruits and vegetables a day was not met by either ethnic group or obese and non-obese women. All groups ate in the order of 3.5 servings per day.

The differences found between the ethnic groups were not as marked in previous studies of older people and suggest that young Polynesian and European women in New Zealand have a relatively homogenous dietary intake of specific fruits and plants.

" Eight plants were eaten exclusively by Polynesian women and two were eaten exclusively by European. Obese women ate more broccoli and less carrot, apricots, kumara and boiled rice than the non-obese. "

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Introduction

There is considerable interest in the protective role of food plants against colorectal cancer and other diseases. In New Zealand and most Western countries, colorectal cancer is the second most common cause of cancer deaths[1]. Epidemiological studies have implicated obesity[2,3] high fat and energy intakes[3] high intake of alcoholic beverage[4], low intakes of food plants[5,6], high body mass index[7,8] and smoking tobacco[9] as risk factors for colorectal cancer. In New Zealand Polynesians are more likely to be exposed to these risk factors than the Europeans[6]. The term Polynesian in this report includes the indigenous Maori of New Zealand and the people from the Pacific Islands.

The age-adjusted incidence of colorectal cancer in New Zealand has been shown by Smith et al[10] and Sutton et al[11] to be lower in Polynesians than European. The source of data for both these studies was the New Zealand National Cancer Registry between 1970 and 1984 for the 1993 study and between 1947 and 1980 for the 1985 study. More recently a Northern Regional Health Authority report[12] presented the following figures for the colonic, rectal and anal cancer figures for the Maori and the non-Maori for the Tainui sub-region (South Auckland) for the periods between January 1988 and December 1992. For non Maori the percentage of deaths from colonic cancer was 9.9% (225 /2275); and for rectal-anal cancer was 4.4% (101/2275). However, for the 147 Maori deaths recorded, no deaths were related to cancer of the colon, rectum or anus. This data was not derived from a population-based study comparing the Maori to the non-Maori. The data was also confounded by the age structure differences. Maori do not live as long as non-Maori and there are relatively more young Maori than non-Maori[13].

These findings do not support the hypothesis suggested by several prospective studies that striking geographical differences in colorectal cancer incidence are related to the environment[1,14]. Although the aetiology of colorectal cancer is multifactorial, experimental evidence points to the strong association of dietary factors with the promotion of the disease. A striking example of the relatively strong influence of the dietary factors to colorectal cancer was shown in an epidemiological study of Japanese emigrants in America after the Second World War[1]. Until the Second World War, colorectal cancer was uncommon in Japan, whereas stomach cancer was more common there than anywhere else in the world. However, it was shown that the Japanese who emigrated to Hawaii and California and adopted the American way of life including its dietary customs, had an almost equivalent colorectal cancer rate with other Americans within a generation. On the other hand, the risk of immigrant Japanese of developing stomach cancer fell.

Burnstein's review[14] suggests that the complex interrelations governing energy balance and the consumption of fat, fibre and micronutrients make it difficult to define the precise role of specific dietary factors in the aetiology of colorectal neoplasm. However, epidemiological[6] and case-control[15] studies have demonstrated a relatively strong correlation between high intake of fruit and vegetables with the low risk of colorectal cancer. To date no conclusive evidence has been presented to explain the difference in the prevalence of colorectal cancer between the Polynesians and Europeans living in New Zealand.

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Ferguson and colleagues[6] showed significant differences in the consumption of certain food plants by Maori, Pacific people and Europeans in New Zealand. Although most of the food plants in their diet were similar, Polynesians ate more frequently of food plants such as broccoli, spinach, onion and pineapple. There were also food plants that were regular dietary items in the Polynesian diet but were relatively absent in the European diet. These included food plants such as; watercress, sweet potato (kumara), the leaves and corms of taro, yams, green banana, boiled rice and coconut cream. They speculated that these food plants in the Polynesian diet may be partially responsible for the lower colorectal cancer incidence in their population than in the European population. They suggested that the quantity of any protective chemicals in food plants is likely to be related to their botanical classification. Their information was derived from a food frequency questionnaire in which 5523 volunteers recorded their usual food intake over the past three months. The period of the study spanned two years and only included people aged 40 to 64 years. The Pacific peoples group had 643 volunteers, Maori 429 and European 4451. Actual quantitative servings of the food plants eaten were not reported.

The aim of this research was to investigate if there were any differences in the quantity and frequency of intake of specific food plants consumed by 80 young (18-27 years) Polynesian and European women[16] which may be related to differences in colorectal cancer incidence. The influence of body composition on reported fruit and vegetable intake was also examined. The specific food plants are presented in terms of the Dahlgren[17] botanical classification as in the Ferguson study.

Method

Dietary intake data were collected from 80 seven day food

ies. These self-reported, household-measured diaries re from a study[16] of differences in metabolism between ynesian and Caucasian women. The volunteers were efully instructed on how to fill in the diary. The diary was reviewed with them at the end of the 7 day collection period, following guidelines reviewed by Dorothy Mackerras[18].

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Eighty two healthy female volunteers aged 18 to 27 years were selected for the Rush study on the basis of their BMI. Forty identified themselves as Polynesian (22 Samoan, 12 Maori, 3 Tongan, 2 Niuean and 1 ok Islander) and 42 European. Half of each ethnic group l a BMI of more than 30 (see Table 1). This spread of BMI s to ensure that the relationships compared applied to ese and non-obese women in each ethnic group equally. MI of 30 kg.m^{-2} or more was defined as obese[19]. Two unteers, one European and one Polynesian did not return ir food diaries despite repeated reminders and have been luded from this analysis.

he requirements of the 7 day diet diary were explained to volunteers and the recording of food intake started at the e of explanation and continued until a second visit 7days r. In the second visit the 7 day food diary measurements s gone over with the volunteers to clarify any points. A d visit a week later was used to discuss the printed analysis

Table 1. Body Mass Index (BMI) selection of the 80 volunteers

Ethnicity	*Obesity*	*Number*	*BMI*
Polynesian	Obese	19	36.5 ± 6.3
	Non–obese*	20	25.5 ± 2.9
	All Polynesian	39	30.7 ± 7.5
Caucasian	Obese	20	36.2 ± 5.0
	Non–obese*	21	22.4 ± 2.4
	All Caucasian	41	29.1 ± 8.0

** includes both normal and overweight categories*

of the macronutrients in the diet. Each volunteer was given a copy of the analysis of their diet.

Data concerning fruit, vegetables and cereal intake were extracted from the food diaries by inspecting and recording the serving sizes of all food plants recorded by each woman. This part of the analyses was objective as the food diaries were identified by a number only.

Fifty-four food plants were categorised from the Dahlgren botanical classification following the format of the Ferguson study[6]. The last four food plants shown in Tables 3 and 5 were additions to the original table. These added plants included; passion fruit, persimmon, cassava and mushroom. (Note - mushroom is not botanically classified as a plant neither is it an animal, rather it is part of the fungi kingdom.) Lynette Ferguson kindly provided the additional classification information for the newly added food plants.

In the Dahlgren botanical classification, angiosperms (flowering plants) are divided into two major groups; monocotyledons and dicotyledons. Monocotyledons are flowering plants with one seed leaf (cotyledon) in its embryo, while a dicotyledon has two seed leaves. The plants were also divided into superorders, orders and families. Edible parts of plants can be divided into four parts; fruit, grains (combined dry fruit and seed, feature of Poaceae) and the vegetative parts of plants, above-ground parts and the underground storage organs.

For this study, a serving size is defined in terms of the quantities specified for servings issued by the New Zealand Public Health Commission of Food and Nutrition guidelines[20]. Examples of serving sizes of food plants defined by the Commission, are listed in Table 2.

Table 2. Serving size examples

Each item represents one serving
Vegetables
1 medium potato or similar sized root vegetable (~135g)
half a cup cooked vegetables (~50–80g)
half a cup salad (~60g)
1 tomato (~80g)
Fruits
1 apple, pear banana or orange (~130g)
2 small apricots or plums (~100g)
half a cup stewed fruit (~135g)
1 cup fruit juice (~250g)
Breads and cereals
1 roll (~50g)
1 muffin (~80g)
1 medium slice of bread (~26g)
1 cup cornflakes (30g)
half a cup muesli (55g)
1 cup cooked pasta (150g)

Data was tested for significant differences in the frequency of food plant eaten by ethnicity and BMI grouping using the Chi-squared test. Differences in the average quantities of specific food plants consumed by those who reported eating the food and total consumption of fruit, vegetables and cereals were tested by Student's independent t-test. Mean daily intakes of fruit, vegetables and cereals are reported ± standard deviation (SD). The 5% level was chosen for statistical significance. The Macintosh software Statview-SE and graphics (Abacus) 68000 version programme was used for these analyses.

Results

Frequency of numbers of Europeans and Polynesians eating specific food plants were similar (Table 3). Broccoli, green peas, wholemeal bread and breakfast cereal were all reported as eaten by more Europeans than Polynesian whilst more Polynesian women ate brussel sprouts and cabbage than European. There were a few food plants that were exclusively eaten by an ethnic group. Melons, breadfruit, cassava, taro, taro leaf, persimmon, tamarillo, swede and green bananas were only eaten by Polynesian volunteers of the study. Food plants that were exclusively eaten by the European volunteers in the study were lentils and asparagus. Of these exclusive foods only the number of Polynesians eating taro and green banana was statistically different from European.

For those reporting eating a food plant average serving size between the two ethnic groups was compared. Only one food plant, potato-chips (fries), was eaten in significantly larger quantities by young Polynesian women ($p = 0.03$) compared with European women in this study. The reported 7 day food diary showed that 28 Polynesian women ate potato-chips, with an average

Table 3. Weekly intake of specific food plants, by ethnic group

Family	Food Plant	Number eating and their mean serving size by ethnic group			
		Polynesian Number eating n=39	Mean weekly serving	European Number eating n=41	Mean weekly serving
	Dicotyledons				
Lauraceae	Avocado	5	1.2	7	0.8
Chenopodiacae	Silverbeet, spinach	3	0.9	5	1.2
Moraceae	Breadfruit	1	1	0	0
(+ Caricaceae	(+Pawpaw, +mango)	3	1	1	1
+Anacardiaceae	Peanuts	9	0.9	4	1.5
Curcurbitaceae	Melon, watermelon	3	3.4	0	0
	Cucumber, courgette, marrow	9	1.0	8	1.8
	Pumpkin	5	1	11	1.0
Brassicaceae	Cauliflower	7	1.1	13	1.5
	Broccoli, brussel sprouts,	8	1.2	20*	1.3
	cabbage	22	2.6	12*	1.8
(+Apiaceae)	Swede (+parsnip)	1	0.3	0	0
(+ Asteraceae)	Watercress (+puha)	0	0	0	0
Rosaceae	Apple, pear	27	2.9	25	3.4
	Strawberry, raspberry	7	1.3	7	1.2
	Apricot, plum, peaches	8	2.5	11	2.3
Myrtaeae (+Solanaceae)	Feijoa (+Tamarillo)	2	3.8	0	0
Fabaceae	Green beans	5	0.6	6	1.3
	Bean sprouts	3	1.7	5	2.9
	Dried beans	4	1.1	2	0.6
	Baked beans	4	1.1	1	0.5
	Green peas	10	1.0	24*	1.5
	Split peas, lentils	0	0	1	1
Rutaceae	Orange, mandarin, grapefruit	24	6.4	28	6.7
Vitaceae	Grapes	5	1.8	8	2.2
Apiaceae	Carrot	20	1.4	23	1.5
	Celery	5	0.6	3	1.3
(+Asteraceae)	(+lettuce)	21	0.7	25	1.16
Solanaceae	Potato–chip (crisps)	24	1.9	16	1.6
	Potato–chip (fries)	28	3.4	25	2.0**
	Potato–boiled	22	1.9	25	2.2
	Potato–baked/roasted	14	1.9	22	2.2
	Tomato	24	1.8	25	2.8
	Capsicum	3	0.8	7	1.2
Convolvulaceae	Sweet potato (kumara)	5	1.8	11	2.0
Actinidiaceae	Kiwifruit	4	2	9	1.6
	Monocotyledons				
Araceae	Taro leaf	2	0.8	0	0
(+Dioscoreaceae)	Taro (+yam)	10	3.4	0*	0
Asparagaceae	Asparagus	0	0	3	0.6
Alliaceae	Onions	13	1.0	15	1.7
Bromeliaceae	Pineapple	8	1.7	12	1.6
Musaceae	Banana–green	9	4.6	0*	0
	Banana–yellow	28	2	26	3.0

** P–value <0.05 difference between numbers of Polynesian and European consuming, Chi–squared test*
*** P–value <0.05 difference between mean weekly serving of those consuming the food plant, Student's independent t test*

Table 3 (cont'd). Weekly intake of specific food plants, by ethnic group

		Number eating and their mean serving size by ethnic group			
Family	*Food Plant*	*Polynesian Number eating n=39*	*Mean weekly serving*	*European Number eating n=41*	*Mean weekly serving*
	Sweet corn	20	2.0	22	1.5
	Bran	1	1	4	1.0
	Maori bread	1	2	1	2
	White bread	37	24.7	38	24.4
Poaceae	Brown bread	3	8.2	5	4.2
	Wholemeal bread	3	12.7	15	9.4
	Mixed grain bread	14	5.4	15	5.8
	Breakfast cereal	18	4.7	27	4.6
	Rice – boiled	25	1.8	24	1.6
Arecaceae	Coconut cream	4	0.3	2	0.2
	Passion fruit	1	1	1	1
Oleaceae	Olives	1	3	1	2.8
Euphorbiaceae	Cassava	1	1	0	0
Ebenaceae	Persimmon	2	1	0	0
	Fungi				
Agaricaceae	Mushroom	8	1.6	7	1.4

number of servings per week of 3.4; while 25 European women had the same food plant but their average serving per week was 2. Although not statistically significant the Polynesian women showed a tendency to report that they ate more peanuts; Brussel sprouts and cabbage, and brown bread and European women that they ate more green beans; celery; lettuce; onion; tomato and yellow banana.

There was no significant difference in the total servings of the fruit, vegetables and cereal per week eaten between groups reported over the seven day period of the study (Table 4). The food plant category of cereal included all the wheat products (e.g. pasta) and breakfast cereals. When cereal intake was excluded there also was no difference in the total number of servings of fruit and vegetables per week (p 0.74) reported eaten by the European and Polynesian women of the study.

Food plant intake and obesity

The relationship of the food plant consumption to the obesity status of the volunteers was examined (Table 5). Most of the food plants consumed by obese and non-obese volunteers were similar with only sweetcorn being eaten by significantly more nonobese people than obese (26 versus 16). Statistical analysis of the average size of the servings reported by those eating a specific food plant showed several species had significantly different consumption rates between the obese and non-obese volunteers. Those eaten in significantly greater quantities by nonobese volunteers included melon ($p=0.04$), apricots, plums and peaches ($p=0.01$), carrot ($p=0.0003$), lettuce ($p=0.05$), sweet potato ($p=0.04$) and boiled rice ($p=0.05$). Broccoli ($p=0.003$) was eaten in greater quantities by the obese participants. There were a few food plants that were exclusively eaten by each group. These food plants included; mango and pawpaw (shown as the food plant family Caricaeae), olives, cassava, taro leaf, swede and lentils, which were eaten only by some of the non-obese volunteers. Food plants eaten only by obese volunteers included breadfruit and tamarillo.

Table 4. Average fruit, vegetable and cereal servings per week, by ethnic group

	Polynesian		*European*		
	mean servings/day n=39	*SD*	*mean servings/day n=41*	*SD*	*p*
Servings of fruit, vegetables and cereal	8.4	2.7	8.4	2.8	0.99
Servings of fruit and vegetables (excluding cereal intake)	3.5	1.6	3.6	1.7	0.74

p is the p–value (Student's independent t–test)

Table 5. Weekly intake of specific food plants, by body size

Family	Food Plant	Number eating and their mean serving size by body size: Obese Number eating n=39	Mean weekly serving	Nonobese Number eating n=41	Mean weekly serving
	Dicotyledons				
Lauraceae	Avocado	4	0.9	8	1.0
Chenopodiaceae	Silverbeet, spinach	3	1.1	5	1.1 1.0
	Beetroot	1	3.4	4	
Moraceae	Breadfruit	1	1	0	0
(+ Caricaceae	(+Pawpaw, +mango)	0	0	4	1
+Anacardiaceae	Peanuts	4	1	9	1.1
Curcurbitaceae	Melon, watermelon	2	2.1	1	6**
	Cucumber, courgette, marrow	9	1.7	8	1.0
	Pumpkin	7	1.2	9	0.9
Brassicaceae	Cauliflower	10	1.5	10	1.2
	Broccoli	14	1.6	14	0.9**
	Brussel sprouts, cabbage	15	2.2	19	2.4
(+Apiaceae)	Swede (+parsnip)	0	0	1	0.3
(+ Asteraceae)	Watercress (+puha)	0	0	0	0
Rosaceae	Apple, pear	24	3.1	28	3.4
	Strawberry, raspberry	5	0.7	9	1.6
	Apricot, plum, peaches	11	1.5	8	3.7**
Myrtaeae (+Solanaceae)	Feijoa (+Tamarillo)	2	3.8	0	0
Fabaceae	Green beans	7	0.7	4	1.4
	Bean sprouts	2	1.1	6	2.8
	Dried beans	4	0.9	2	1.1
	Baked beans	3	1.2	2	0.8
	Green peas	16	1.3	18	1.3
	Split peas, lentils	0	0	1	1
Rutaceae	Orange, mandarin, grapefruit	25	7.5	27	5.7
Vitaceae	Grapes	8	1.8	5	2.4
Apiaceae	Carrot	23	0.9	20	2.0**
	Celery	4	0.8	4	0.8
(+Asteraceae)	(+lettuce)	23	0.7	23	1.2**
Solanaceae	Potato–chip (crisps)	19	1.6	21	1.9
	Potato–chip (fries)	23	2.8	30	2.3
	Potato–boiled	25	2	22	2.07
	Potato–baked/roasted	16	2.0	20	2.2
	Tomato	28	2.1	21	2.5
	Capsicum	4	0.8	6	1.3
Convolvulaceae	Sweet potato (kumara)	8	1	8	2.8**
Actinidiaceae	Kiwifruit	7	1.3	6	2.3
	Monocotyledons				
Araceae	Taro leaf	0	0	2	0.8
(+Dioscoreaceae)	Taro (+yam)	6	3.6	4	3.2
Asparagaceae	Asparagus	1	0.4	2	0.6
Alliaceae	Onions	15	1.3	13	1.4
Bromeliaceae	Pineapple	11	1.8	9	1.5
Musaceae	Banana–green	3	8.3	6	2.8
	Banana–yellow	28	2.4	26	2.6

** P–value <0.05 difference between numbers of obese and nonobese consuming, Chi–squared test*

· P–value <0.05 difference between mean weekly serving of those consuming the food plant, Student's independent t test

Table 5 (cont'd). Weekly intake of specific food plants, by body size

		Number eating and their mean serving size by body size			
Family	*Food Plant*	*Obese Number eating n=39*	*Mean weekly serving*	*Nonobese Number eating n=41*	*Mean weekly serving*
Poaceae	Sweet corn	16	1.7	26*	1.8
	Bran	1	0.2	4	1.2
	Maori bread	1	2	1	2
	White bread	38	22.8	37	26.4
	Brown bread	3	4.7	5	6.3
	Wholemeal bread	17	9.9	11	12.6
	Mixed grain bread	12	7.3	17	4.4
	Breakfast cereal	24	3.7	21	5.7
	Rice – fried	5	3	9	2.7
	Rice – boiled	25	1.3	24	2.1**
Arecaceae	Coconut cream	3	0.3	3	0.2
	Passion fruit	1	4	1	1
Oleaceae	Olives	0	0	2	2.9
Euphorbiaceae	Cassava	0	0	1	1
Ebenaceae	Persimmon	2	1	0	0
	Fungi				
Agaricaceae	Mushroom	6	1.5	9	1.5

* *P–value <0.05 difference between numbers of obese and nonobese consuming, Chi–squared test*
· *P–value <0.05 difference between mean weekly serving of those consuming the food plant, Student's independent t test*

There was no significant difference in the reported number of servings of fruit, vegetables and cereals (see Table 6). When cereal products were excluded from this analysis no significant difference between obese and non obese volunteers was found. These findings were surprising given the expectation that to meet the greater energy requirements of the obese volunteers that larger numbers of servings of fruit, vegetables and cereals would be reported by this group.

Discussion

This study indicated that some food plants had significant consumption differences between the Polynesians and the Europeans of New Zealand as was suggested by Ferguson et al[6]. Their survey demonstrated that Polynesians ate more often of the food plants such as silverbeet, spinach, puha, sweet potato (kumara), taro leaf, taro, onions, pineapple, green banana, yellow banana, "bran", brown bread, boiled rice and coconut cream than the Europeans. We did show that Polynesians ate more brown bread and green bananas but in opposition to the Ferguson findings we show a greater consumption of deep fried potato chips by the Polynesian women and lesser consumption of onions, yellow banana, green beans, celery and lettuce.

Only one food plant consumed by more than half of each ethnic group, deep fried potato chip was found to be consumed in significantly (p=0.03) greater quantities (50% more) by the Polynesian group. Nonobese women reported eating greater quantities of carrots, apricot, lettuce, kumara and boiled rice and lesser quantities of broccoli than obese. The biological significance and association if any with body size remains to be explained.

There was no significant difference in the total fruit, vegetable and cereal intake per week between the Polynesian and European volunteers of the study. Similar observations were shown between the obese and nonobese groups yet the expectation was that obese individuals would consume more food to maintain their body mass. Obese women have been shown[16,21] to under-report total food intake more than nonobese. The reported rate of consumption of fruit and vegetables (excluding cereals) was below the recommendations of the New Zealand Public Health Commission[22]. These state that three servings of vegetables and two servings of fruit each day (i.e. five servings of fruit and vegetables per day) are required for health. For this reported survey, the total servings of fruit and vegetables per week for Polynesians was 24.6 (or 3.5 servings per day) and 25.5 (or 3.6 servings per day) for Europeans.

The Ferguson study showed greater differences in food plant consumption of older Polynesian and European people. The suggestion from our study is that the younger generation of Polynesians born and bred in New Zealand have assimilated into a more homogenous New Zealand lifestyle. Therefore, their diet (particularly of food plants) is more likely to be similar to European than with the older Polynesians.

This study was limited by sampling time (7 days) and numbers of participants. It is recognised that because of the large numbers of t-tests made that the likelihood of finding a difference when there isn't one is increased. The small numbers of participants and the fact that Maori and Pacific women were grouped as Polynesian means that significant differences between the groups may not be detected. But Maori and Pacific women are more culturally (and genetically) similar than New Zealand European and the broader comparison has some validity. The data was not controlled for season, food availability and numerous other socio-economic and environmental factors that may directly influence the performance of the volunteers in the 7-day period of the study. Furthermore, a diet recorded in 7 consecutive days cannot be extrapolated to determine the fruit and vegetable diet pattern for another week, month or year or for an entire lifetime or be directly compared with a food frequency questionnaire[23].

This study was of a relatively small, nonrandom sample of 80 women volunteers and therefore may not represent a larger population sample[24]. Thus the finding that young Polynesians and Europeans of the study have slightly different consumption patterns of food plants may not be applicable to the population of New Zealand. The small volunteer number in this study (n = 80) and short study time could partially explain why some food plants were not reported as eaten. The effect of this small sample size was accentuated when some food plants in the study were exclusively associated with only one ethnic group. But given the limited age range of the volunteers the results may be extraplolated to young Polynesian and European women mainly in tertiary education in Central Auckland.

" ... the finding that young Polynesians and Europeans of the study have slightly different consumption patterns of food plants may not be applicable to the population of New Zealand. "

The study hypothesis proposed by former studies[6] needs to be further investigated. Burnstein's 1993 review[14] stated that the design of potential future studies must control for variations in energy balance as a confounding factor. He also suggested that the results from short-term studies can be utilised for designing large-scale prospective studies. Prospective and case-control studies should include food frequency questionnaires and food diaries for periods longer than that of this study (at least for two years). These collaborative longitudinal studies would measure the direct relationship of food plant consumption to the incidence or development of colorectal cancer in target populations.

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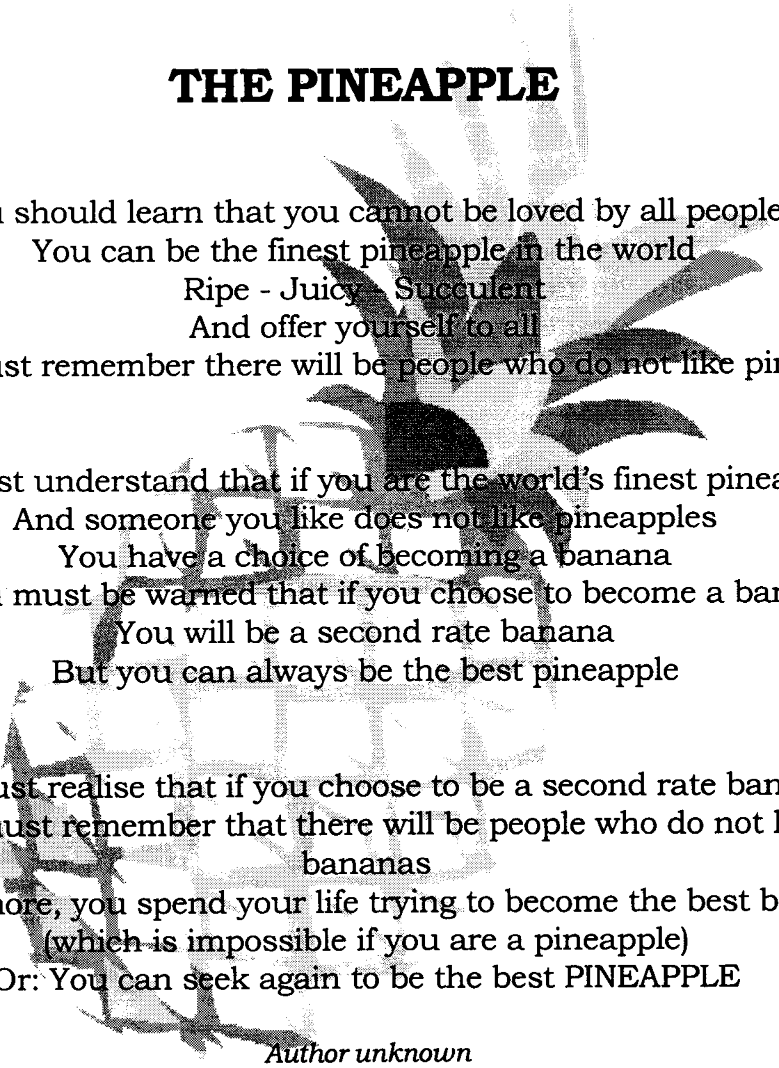
THE PINEAPPLE



You should learn that you cannot be loved by all people
You can be the finest pineapple in the world
Ripe - Juicy - Succulent
And offer yourself to all
But you must remember there will be people who do not like pineapples

You must understand that if you are the world's finest pineapple
And someone you like does not like pineapples
You have a choice of becoming a banana
But you must be warned that if you choose to become a banana
You will be a second rate banana
But you can always be the best pineapple

You must realise that if you choose to be a second rate banana
You must remember that there will be people who do not like bananas
Furthermore, you spend your life trying to become the best banana
(which is impossible if you are a pineapple)
Or: You can seek again to be the best PINEAPPLE

Author unknown